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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/799,020
Filing Date: March 11, 2004
Appellant(s): GROT ET AL.

J. Krause-Polstorff
For Appellant

EXAMINER'S ANSWER

This is a corrected copy of the Answer responding to the appeal brief filed November 17, 2006 appealing from the Office action mailed March 15, 2006. The only substantive changes have been to section 1 "Real Party in Interest," which was previously missing.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner. The rejection of claims 1, 4, 7, 22, and 23 under 35 U.S.C. 102(e) as being anticipated by Shirane et al. (6,937,781) is withdrawn. The rejection of claims 1, 9-12, and 18-21 under 35 U.S.C. 103(a) as being unpatentable over Platzman (6,697,542) is withdrawn.

GROUNDS OF REJECTION NOT ON REVIEW

The following grounds of rejection have not been withdrawn by the examiner, but they are not under review on appeal because they have not been presented for review in the appellant's brief. Applicant has not argued the provisional double patenting rejection of claims 1, 9, and 24. Claims 1, 9, and 24 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 8 of copending Application No. 11/078,785 in view of Miller et al. (2004/0027646).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2004/0062505	Sugitatsu et al.	4-2004
2004/0027646	Miller et al.	2-2004
2004/0033009	Soljacic et al.	2-2004
6,697,542	Platzman et al.	2-2004
2005/0175304	Romagnoli et al.	8-2005
U.S. Pat. App. No. 11/078,785	Grot et al.	9-2005

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims.

I. Claims 1, 5, 7, 14, 15, and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Sugitatsu et al. (2004/0062505).

Claims 1, 5, 7, 14, 15, and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Sugitatsu et al. (2004/0062505). Sugitatsu et al. (2004/0062505), hereinafter referred to as "Sugitatsu", teaches an apparatus and method comprising a 2-D photonic crystal sensor apparatus comprising: a waveguide (e.g. fiber in p. 53) for inputting light (e.g. from a laser diode or the like); and a photonic crystal slab (e.g. 4) with a periodic triangular lattice, optically coupled to said waveguide, said crystal comprising a 2-D periodic lattice of holes comprising a lattice constant and at least one defect hole (e.g. 6, 41) – a linear defect with respect to the periodic lattice. The photonic crystal slab (e.g. 4) operable to confine said light in said defect hole at an operating wavelength. Where in the exciting light (51) may create laser emission (e.g. 52) in a direction perpendicular to said photonic crystal slab. (See e.g. p. 53-56)

During operation, a photodetector (e.g. 61) may be placed out of the plane of the photonic crystal slab to detect light at an operational wavelength of the sensor (e.g. 10). (See e.g. Fig. 16) Sugitatsu additionally teaches that the device (10) and method may be operable in an optical switch to control the passage of signals. (See e.g. p. 44-102, and Figs. 4-16)

II. Claims 1, 2, 3, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. (2004/0027646) in view of Romagnoli et al. (2005/0175304).

Claims 1, 2, 3, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. (2004/0027646) in view of Romagnoli et al. (2005/0175304). Miller et al. (2004/0027646), herein after referred to as "Miller", teaches an apparatus and method for controlling the propagation of an electro magnetic radiation comprising, placing photonic band gap medium (e.g. 401) – having a surface and a photorefractive medium – in the path of the electromagnetic radiation; and projecting control radiation (e.g. light) onto the surface that spatially varies a refractive index of the photorefractive material there across to control propagation of the electromagnetic radiation through the bandgap medium. When the spatial control radiation is applied, a defect path is defined in the photorefractive medium, which guides the electromagnetic radiation traveling in said medium. Miller additionally teaches that the resonance (thus filtering, passband, reflection, etc..) frequency of the PBG material may be adjusted via size of the defect which enables PBG behavior. (See e.g. p. 24, 39-46, 65-67, 82 and Figs. 5-7, and 10).

Romagnoli et al. (2005/0175304), herein after referred to as "Romagnoli", teaches an apparatus and method comprising 2-D and 3-D photonic crystal sensor apparatus comprising: a waveguide (e.g. 5) for inputting light (e.g. 6) from laser (4) to an output waveguide (22). Additionally, a photonic crystal slab (e.g. 1) with a periodic linear triangular lattice of defect

holes (2), optically coupled to said waveguide, said crystal comprising a 2-D periodic lattice of holes comprising a lattice constant and an area of liner defect holes (e.g. p. 111). The photonic crystal slab (e.g. 1) operable to confine said light in said defect hole at an operating wavelength.

Regarding claim 1; Millar does not explicitly teach an input or outcouple waveguides. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ input and output waveguides in the invention of Millar at taught by Romagnoli to provide light to the device and method. One would be motivated to do so because it would provide an efficient means for launching / outcoupling light to/from the crystal.

Regarding claims 2 and 3; Millar in view of Romagnoli does not teach defect holes that have a larger or smaller volume than the lattice holes.

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ defect holes which have a larger or smaller volume than the lattice holes because as is well known in the art that the size of the defect hole determines the operating frequency of the device, as taught for example by Millier (See p. 24 and Figs. 6 and 7). One would have been motivated to do so because this would allow integration of the device with various input frequencies.

Regarding claim 6; neither Romagnoli nor Miller teach defect holes with a substantially elliptical cross-section. However, Miller does teach that the resonance (thus filtering, passband, reflection, etc...) frequency of the PBG material may be adjusted via the size of the defect which enables PBG behavior and that the defect's size and shape may be changed via applied energy – thus the defect holes may yield substantially elliptical cross-sections. One would have been

motivated to do so because it would allow an efficient device and method via, for example, allowing the response frequencies of the device to be dynamically tuned.

III. Claims 1 and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soljacic et al. (2004/0033009) in view of Sugitatsu et al. (2004/0062505), in further view of Miller (2004/0027646).

Claims 1 and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soljacic et al. (2004/0033009) in view of Sugitatsu et al. (2004/0062505), in further view of Miller (2004/0027646). Soljacic et al. (2004/0033009), herein after referred to as "Soljacic", teaches a 2-D photonic crystal sensor apparatus comprising: a photonic crystal slab comprising a 2-D period lattice of holes (e.g. filled holes 4), said slab operable to confine light at a plurality of operating wavelengths to said plurality of defect holes; and a substantially straight line of defects defining a waveguide (e.g. 14,6) optically coupling the plurality of defect holes (e.g. center rods 8). Following it is taught that the defect holes do not all have the same volume. (See e.g. p. 16-25 and Figs. 1, 7A)

Sugitatsu et al. (2004/0062505). Sugitatsu teaches an apparatus and method comprising photonic crystal sensor apparatus as discussed above.

Soljacic teaches the standard photonic crystal hole medium comprise filled rods rather than empty holes. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ holes rather than filled holes (e.g. rods) as they are interchangeable in the art – as taught for example by Miller (see e.g. p. 6) – depending on the desired difference in index of refraction. As would be evident to one of ordinary skill in the art at the time of the invention attempting to make an efficient device, the apparatus is arranged in an order to maximize the

optical coupling of the waveguide to the plurality of defect holes. (See e.g. p. 16-25 and Figs. 1, 7A)

It is also not explicitly taught that the photo detector employs a slope based detection system. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a slope based detection system in the invention of Sugitatsu because it would allow an efficient detection means.

IV. Claims 1, 9-12, and 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Platzman (6,697,542).

Claims 1, 9-12, and 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Platzman (6,697,542). Platzman (6,697,542), herein after referred to as "Platzman", teaches an apparatus and method comprising a 2-D photonic crystal sensor apparatus comprising: a waveguide (e.g. 12) for inputting light; and a photonic crystal slab (e.g. 18) optically coupled to said waveguide, said crystal comprising a 2-D periodic lattice of holes comprising a lattice constant and at least one defect hole (e.g., 24, 26). The photonic crystal slab operable to confine said light in said defect hole at an operating wavelength. When a spatial control radiation is applied, a defect path is defined in the photorefractive medium, which guides the electromagnetic radiation traveling in said medium. Additionally, Platzman teaches that the path of light passing through the crystal may be switched. (See e.g. Col. 3, ll. 20 – Col. 6, ll. 40 and Figs. 1-2)

Platzman does not explicitly teach how the operating wavelength is selected or the number of laser inputs. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ multiple lasers, a dither system, or a synchronized scanning system in

the invention of Platzman because this would yield efficient means for selecting and controlling the wavelengths of light employed in the system.

Platzman does not explicitly teach numerous waveguide inputs, or the various methods that may be employed to control light input into the crystal.

Since providing multiple waveguides for launching light into an optical switch is notoriously well known in the art, as taught for example by Paniccia et al. (6,504,965), it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a plurality of input waveguides into the switch of Platzman because this would yield an efficient device such as allowing switching of a plurality of bands.

Following, it would also have been obvious to one of ordinary skill in the art at the time of the invention to optically address the plurality of waveguides with a dynamically reconfigurable diffractive array generator or MEMS mirror array in the invention of Platzman because they are efficient means for directing light waves as taught, for example, by Paniccia (See e.g. Col. 7, ll. 25-45).

V. Claims 1, 9, and 24 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 8 of copending Application No. 11/078,785 in view of Miller et al. (2004/0027646).

Claims 1, 9, and 24 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 8 of copending Application No. 11/078,785 in view of Miller et al. (2004/0027646). The only recited difference between claims 1 and 24 of the instant invention and claim 1 of Application No. 11/078,785 is the intended use of tuning the crystal to detect certain particle sizes (e.g. a certain operating frequencies). It is well know that the operating frequency may be determined via adjusting the

defect hole size as taught by Miller (See p. 24 and Figs. 6 and 7). Claim 9 of the instant application is the same as claim 8 of 11/078,785.

It would have been obvious to one of ordinary skill in the art at the time of the invention to tune the device of the instant application to a nanometer wavelength. One of ordinary skill in the art would have been motivated to do so because it would allow efficient operation in commonly used wavelengths, e.g. 1554 nm. Hence, the device is capable of performing the intended use.

This is a provisional obviousness-type double patenting rejection.

(10) Response to Argument

I. Applicant's argument for allowance of each independent claim focuses on the same two issues: (1) the patentable weight given to the term "sensor" in the preamble and (2) the recitation of "operable to confine" in the body.

Applicant's argument for allowance of each independent claim focuses on the same two issues: (1) the patentable weight given to the term "sensor" in the preamble and (2) the recitation of "operable to confine" in the body. Neither argument is persuasive.

A. First, the recitation to a "sensor" in the preamble to the claims is not given patentable weight because it does not breath life into the meaning of the claims. Even if this preamble limitation were given patentable weight, it would not differentiate the claims from inherent properties of photonic crystals.

First, the recitation to a "sensor" in the preamble to the claims is not given patentable weight because it does not breath life into the meaning of the claims. Even if this preamble limitation were given patentable weight, it would not differentiate the claims from inherent properties of photonic crystals. A preamble is not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of

the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. *See In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976); *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

Here, every independent claim (1, 15, 18, 22 and 24) recites a "photonic crystal sensor" (e.g. claim 1, l. 1) in the preamble with no recitation to a "sensor" in the body. Further, the claims' bodies do not recite any structural or functional limitation that would indicate a "sensor" to one of ordinary skill in the art. The claims recite limitations that are, as discussed below, well known inherent aspects of photonic crystals.

Applicant specifically defines the term "photonic crystal sensor" in the specification as "an optical sensor that uses a photonic crystal to localize the optical field or light in a volume having an average dielectric susceptibility lower than that of the surrounding material." (Page 4.) This definition contains two elements, (1) an "optical sensor" that (2) "uses a photonic crystal to localize … light in a volume …." (*See Id.*) The specification does not explicitly define what the first element, an "optical sensor", comprises. The second element, "a photonic crystal …", is not a significantly limiting definition because it merely states the well-known inherent aspects of photonic crystals. (*See e.g.*, Miller et al. 2004/0027646.)

Miller discloses—as background—well known inherent aspects of photonic crystals. (*Id.* at ¶ 3-4.) There is considerable interest in photonic crystals because of their ability to control the wavelength (frequency) of light propagation. (*Id.* at ¶ 4.) Photonic crystals control light propagation in an analogous manner to how semiconductors control electrical conductivity. (*Id.*) A key aspect of semiconductors' utility is the presence of an electronic band gap that allows substantial control over the flow of electrons in the semiconductor material. Electrical

conductivity is controlled by the presence of defects, which interrupt—or perturb—the regular periodicity of a semiconductor crystal lattice. The defects' produce allowed and forbidden paths of electron flow. (*Id.* at ¶ 3.) Defects may comprise dopants or other materials, impurities and structural irregularities such as vacancies (i.e. holes) or interstitial atoms. (*See Id.*) Defect concentration and type (e.g. holes, larger or smaller atoms) yield enormous flexibility in controlling the exact conductivity and flow of electrons through semiconductors. (*See Id.*) This flexibility is at the heart of virtually all of the important effects associated with computers and other electronic devices. (*Id.* at ¶ 3.) Photonic crystals operate in an analogous manner. (*Id.* at ¶ 4.)

A photonic crystal functions as a "semiconductor for light" in that it may have a photonic band gap defining the electromagnetic frequencies (wavelengths) that are able to propagate in the crystal. (*Id.*) An example of a photonic crystal is flat dielectric slab that contains a periodic arrangement of small holes—or a macroscopic dielectric medium of air holes as referenced by Miller—aligned along the thin dimension of the slab. (*See Id.*) This structure may be viewed as a periodic arrangement of air holes where refractive index difference between the dielectric slab and air holes—in the two dimensional case, or air rods in the three dimensional case—affects the band of wavelengths that may propagate in (or be reflected from) the crystal. (*Id.* at ¶ 4-5.) This photonic band gap depends on the size, spacing and periodicity (in one, two or three dimensions) of the air holes. (*Id.* at ¶ 7.) Similar to semiconductors, interrupting (perturbing) the arrangement of the periodic structure of the photonic crystal creates photonic states within the photonic band gap of the crystal. (*Id.* at ¶ 8.) Varying the size, position or optical constants of the air holes changes these perturbations. (*Id.*) As in semiconductors, creating a perturbation in

the crystal lattice of a photonic crystal by a larger, smaller or missing element changes the energies (i.e. frequencies or wavelengths) that may propagate in the medium. (*See Id.*) This ability to crate photonic states allows control over the frequencies (wavelengths) of light that are propagated, localized (e.g. confined) or otherwise influenced by the photonic crystal. (*See Id.* at ¶ 8-9.) The entire crystal structure of the photonic crystal—including air hole defects—acts to confine light (or electromagnetic energy) at an operating wavelength in the photonic crystal. (*See Id.* at ¶ 5-8.) Photonic crystals' ability to direct, localize, or confine a specific band of wavelengths enable their use in a wide range of devices such as: lasers, filters, waveguides, switches, and modulators. (*See Id.* at ¶ 9.)

Applicant's definition for a "photonic crystal sensor" contains two elements, (1) an "optical sensor" that (2) "uses a photonic crystal to localize the optical field or light in a volume having an average dielectric susceptibility lower than that of the surrounding material." (*See* Page 4) Applicant does not, as previously noted, define an "optical sensor". Based on the full disclosure, it is conceivable that applicant could intended an "optical sensor" to comprise a device that is responsive (e.g. reflecting, propagating or confining) to a particular photonic band of wavelengths. However, this concept of a sensor is not different from the well-known inherent aspects of photonic crystals as disclosed by Miller. (*See* Miller at ¶ 3-9.) A photonic crystal will only allow certain wavelengths to propagate. (*See Id.*) Thus, a photonic crystal is inherently a "sensor" in that it will indicate when a specific wavelength is present by either reflecting or passing that wavelength. (*See Id.*)

Similarly, the second element of applicant's definition is not different from the well-known inherent aspects of lightwave interaction (e.g. localization, confinement or propagation)

of photonic crystals as disclosed by Miller. (*See* Miller at ¶ 3-9.) Similar to semiconductors, a perturbation in the crystal lattice of a photonic crystal caused by a larger, smaller, or missing (hole) constituent changes the energies (i.e. frequencies or wavelengths) of light interaction (e.g. localization, confinement or propagation) with the photonic crystal. (*See Id.* at ¶ 8-9.) When an electromagnetic lightwave interacts with a photonic crystal it is spread across the entire crystal structure—including the slab material and the air hole defects. Thus, lightwaves falling within the passband of the photonic crystal will be localized a volume having an average dielectric susceptibility lower than that of the surrounding material.

For these reasons, the recitation to a "sensor" in the preamble to the claims is not given patentable weight because it does not breath life into the meaning of the claims. Even if this preamble were given patentable weight it would not differentiate the claim from inherent properties of photonic crystals.

B. Second, the recitation of "operable to confine" in the body of each independent claim does not differentiate the claimed invention over the inherent properties of phonic crystals in the applied references.

Second, the recitation of "operable to confine" in the body of each independent claim does not differentiate the claimed invention over the inherent properties of phonic crystals in the applied references. Miller discloses, as discussed above, that similar to semiconductors, a perturbation in the crystal lattice of a photonic crystal caused by a larger, smaller, or missing constituent changes the energies (i.e. frequencies or wavelengths) of light interaction (e.g. localization, confinement or propagation) with the photonic crystal. (*See Id.* at ¶ 8-9.) When an electromagnetic lightwave interacts with a photonic crystal it is spread across the entire crystal

structure—including air hole defects. Thus, light is confined in a hole defect at an operating wavelength of the photonic crystal. (*See Id.* at ¶ 5-8.)

II. Applicant unpersuasively argues that Sugitatsu teaches neither a "sensor" as recited in the claim preambles, nor a waveguide "operable to confine" light in a defect hole.

Applicant unpersuasively argues that Sugitatsu teaches neither a "sensor" as recited in the claim preambles, nor a waveguide "operable to confine" light in a defect hole. (P. 11-12) This argument regarding the preamble is not persuasive. The recitation to a "sensor" in the preamble is not given patentable weight because it does not breath life into the meaning of the claims. Even if this preamble limitation were given patentable weight, as discussed above, it would not differentiate the claim from inherent properties of photonic crystals. (*See* Miller at ¶ 3-9.) Applicant does not, as previously noted, explicitly define a "sensor" in the specification. Based on the full disclosure, it is conceivable that applicant could intended a "sensor" to comprise a device that is responsive (e.g. reflecting, propagating or confining) a particular photonic band of wavelengths. However, this concept of a sensor is not different from the well-known inherent aspects of photonic crystals as disclosed by Miller. (*See* Miller at ¶ 3-9)

Additionally, Sugitatsu teaches a sensor as interpreted by the plain meaning of a "sensor" to one of ordinary skill in the art. Sugitatsu teaches an emitter (e.g. 41) connected to a detector (e.g. 61), which in turn is connected to controllers (e.g. 62, 63) that allow control of the device. (See e.g. Fig. 16) Thus, as the emitted light is detected and this detection provides a function in the device, the device operates as a sensor.

The argument regarding Sugitatsu not teaching a waveguide "operable to confine" light in a defect hole is not persuasive because this is inherent in the structure of Sugitatsu. Sugitatsu teaches photonic crystal waveguide which controls lightwave energy by the presence of holes.

This ability to crate photonic states allows control over the frequencies (wavelengths) of light interaction (e.g. localization, confinement or propagation) with the photonic crystal. (*See* Miller at ¶ 8-9.) When an electromagnetic lightwave interacts with a photonic crystal it is spread across the entire crystal structure—including air hole defects. Thus, light is confined in a hole defect at an operating wavelength of the photonic crystal. (*See Id.* at ¶ 5-8.)

III. Applicant unpersuasively argues that Miller in view of Romagnoli teaches neither a "sensor" as recited in the claim preamble, nor a waveguide operable to confine light in a defect hole and that there is no motivation to combine the references. (*Id.*)

Applicant unpersuasively argues that Miller in view of Romagnoli teaches neither a "sensor" as recited in the claim preamble, nor a waveguide operable to confine light in a defect hole and that there is not a motivation to combine the references. (P. 14-15.)

This argument regarding the preamble is not persuasive. The recitation to a "sensor" in the preamble is not given patentable weight because it does not breath life into the meaning of the claims. Even if this preamble limitation were given patentable weight, as discussed above, it would not differentiate the claim from inherent properties of photonic crystals. (*See* Miller at ¶ 3-9.) Applicant does not, as previously noted, explicitly define a "sensor" in the specification. Based on the full disclosure, it is conceivable that applicant could intended a "sensor" to comprise a device that is responsive (e.g. reflecting, propagating or confining) a particular photonic band of wavelengths. However, this concept of a sensor is not different from the well-known inherent aspects of photonic crystals as disclosed by Miller. (*See* Miller at ¶ 3-9.)

The argument regarding Miller in view of Romagnoli not teaching a waveguide operable to confine light in a defect hole is not persuasive because this is inherent in the structure of a photonic crystal. Miller teaches photonic crystal waveguide which controls lightwave energy by

the presence of holes. This ability to crate photonic states allows control over the frequencies (wavelengths) of light interaction (e.g. localization, confinement or propagation) with the photonic crystal. (*See* Miller at ¶ 8-9.) When an electromagnetic lightwave interacts with a photonic crystal it is spread across the entire crystal structure—including air hole defects. Thus, light is confined in a hole defect at an operating wavelength of the photonic crystal. (*See Id.* at ¶ 5-8.)

Applicant's argument regarding the motivation to combine Miller and Romagnoli is not persuasive. Millar does not explicitly teach an input or output waveguides. Romagnoli teaches a photonic crystal, which employs commonly used input and output waveguides. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ input and output waveguides in the invention of Millar at taught by Romagnoli to provide light to the device and method. One would be motivated to do so because it would provide an efficient means for launching (inputting) / outcoupling (outputting) light to/from the crystal.

IV. Applicant unpersuasively argues that Soljacic in view of Sugitatsu, in further view of Miller teaches neither a "sensor" as recited in the claim preamble, nor a waveguide operable to confine light in a defect hole and that the references are non-analogous art.

Applicant unpersuasively argues that Soljacic in view of Sugitatsu, in further view of Miller teaches neither a "sensor" as recited in the claim preamble, nor a waveguide operable to confine light in a defect hole and that the references are non-analogous art. (P. 16-17.)

This argument regarding the preamble is not persuasive. The recitation to a "sensor" in the preamble is not given patentable weight because it does not breath life into the meaning of the claims. Even if this preamble limitation were given patentable weight, as discussed above, it would not differentiate the claim from inherent properties of photonic crystals. (*See* Miller at ¶

3-9.) Applicant does not, as previously noted, explicitly define a "sensor" in the specification. Based on the full disclosure, it is conceivable that applicant could intended a "sensor" to comprise a device that is responsive (e.g. reflecting, propagating or confining) a particular photonic band of wavelengths. However, this concept of a sensor is not different from the well-known inherent aspects of photonic crystals as disclosed by Miller. (*See* Miller at ¶ 3-9.)

The argument regarding Soljacic in view of Sugitatsu in further view of Miller not teaching a waveguide operable to confine light in a defect hole is not persuasive because this is inherent in the structure of a photonic crystal. (*See* Miller at ¶ 8-9.) Photonic crystal waveguides control lightwave energy by the presence of perturbations—or holes. These perturbations create photonic states that give control over the frequencies (wavelengths) of light interaction (e.g. localization, confinement or propagation) with the photonic crystal. (*See Id.*) When an electromagnetic lightwave interacts with a photonic crystal it is spread across the entire crystal structure—including air hole defects. Thus, light is confined in a hole defect at an operating wavelength of the photonic crystal. (*See Id.* at ¶ 5-8.)

Applicant argues that Soljacic, Sugitatsu, and Miller are not analogous art. This argument is not persuasive because the inventions of Soljacic and Sugitatsu are both photonic crystals wherein it is taught that the lattice perturbations effect the interaction of the crystal with light. (*See* Soljacic ¶ 16-25, Figs. 1, 7A); Sugitatsu ¶ 44-102, Figs. 4-16.) Millar is applied as a teaching reference, as discussed above, to teach the well-known inherent properties of photonic crystals. Additionally, the inventions of Sugitatsu and Miller were classified in Class 385 (Waveguides) in their resulting U.S. Patents. (U.S. Patent No. 7,181,120; 6,859,304.) Soljacic is

still under prosecution, but is preliminary classified in Class 385. For these reasons, these references are not non analogous art.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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